UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P O Box 1450
Alexandria, Virginia 22313-1450
www uspto gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/531,009	10/03/2005	Benjamin Morris Gordon	920602-99276	2697

23644 7590 05/02/2008
BARNES & THORNBURG LLP
P.O. BOX 2786
CHICAGO, IL 60690-2786

EXAMINER	
LUO, DAVID S	

ART UNIT	PAPER NUMBER
4192	

NOTIFICATION DATE	DELIVERY MODE
05/02/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patent-ch@btlaw.com

Office Action Summary	Application No.	Applicant(s)	
	10/531,009	GORDON ET AL.	
	Examiner	Art Unit	
	DAVID S. LUO	4192	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 October 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 October 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 2, 5, 7, 8, 11 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,801,509 to Sawa published September 1, 1998.

3. As to claim 1, Sawa teaches a controller (Sawa fig. 3: 100B “motor control apparatus) for a synchronous motor (Sawa fig. 3: 200), the controller being operable in use to receive from sensor means coupled to a synchronous motor actual angular displacement signals representative of angular displacements from a reference orientation of a rotor of a synchronous motor (Sawa fig. 3: 300 “encoder”, 123B “angular signal detector”), to transmit the actual angular displacement signals to a controllable alternating current (ac) supply for the motor (Sawa fig. 3: 124B “current command generator” which is used to transmit the actual angular displacement signals to the current controller [Sawa fig. 3: 126] to supply AC current for the motor [Sawa fig.3: 200]) , periodically to measure one or more parameters (Sawa fig. 3: 121 “speed detector”, 126 “current controller” and 140 “power supply voltage detector” which are related to the torque of a synchronous motor[speed, voltage, current are used to determine a motor torque]) related to the torque of a synchronous motor, and between transmissions of the actual angular displacement signals, to derive from the actual angular displacement signals and measured parameters at least one estimated angular displacement signal representative of an estimated angular displacement

from a reference orientation of a rotor of a synchronous motor, to enable the controller to cause to flow between the supply and a synchronous motor a generally sinusoidal current that is synchronized to the angular displacement of the rotor from the reference orientation (Sawa fig. 3 and col. 7: lines 5-58 where the angular displacement signal is detected by Sawa fig. 3: "123B" and is used to enable the controller to cause to flow between the supply and a synchronous motor a generally sinusoidal current that is synchronized to the angular displacement of the rotor).

4. As to claim 2, Sawa teaches a controller as claimed in claim 1, which is operable periodically to measure one or more parameters related to a torque of a synchronous motor, which parameters include a voltage across, or a current flowing in, a winding of the motor (Sawa fig. 3: 121 "speed detector", 126 "current controller" and 140 "power supply voltage detector" which are related to the torque of a synchronous motor[speed, voltage, current are used to determine a motor torque]).

5. As to claim 5, Sawa teaches a controller as claimed in claim 1, which is operable periodically to receive a first signal proportional to a voltage applied across a winding of a synchronous motor (Sawa fig. 3: 140 "power supply voltage detector"), and a second signal proportional to a current flowing between the supply and the motor (Sawa fig. 3: 126 "current controller"), said first and second signals constituting said parameters.

6. As to claim 7, Sawa teaches a controller as claimed in claim 1, which is operable periodically to derive from the actual angular displacement signals and measured parameters an estimated angular velocity signal representative of an estimated angular velocity of the rotor (Sawa fig. 3: 300 "encoder"), and to transmit the estimated angular velocity signal to an angular velocity governor (Sawa fig. 3: 121 "speed detector" and 122 "speed controller").

7. As to claim 8, Sawa teaches a synchronous motor drive comprising a controller (Sawa fig. 3: 100B "motor control apparatus") as claimed in claim 1, a synchronous motor (Sawa fig. 3: 200), a controllable alternating current (ac) supply (Sawa fig. 3:113 "inverter"), and sensor means coupled to a rotor of the motor (Sawa fig. 3: 300 "encoder", 123B "angular signal detector") and operable periodically to transmit to the controller an actual angular displacement signal representative of an angular displacement from a reference orientation of the rotor (Sawa fig. 3: 124B "current command generator" which is used to transmit the actual angular displacement signals to the current controller [Sawa fig. 3: 126] to supply AC current for the motor [Sawa fig.3: 200]), the controllable ac supply being operable to receive actual and estimated angular displacement signals from the controller and, in response to the angular displacement signals, to supply to each winding of the motor a generally sinusoidal current that is synchronized to the angular displacement of the rotor from the reference orientation (Sawa fig. 3 and col. 7: lines 5-58 where the angular displacement signal is detected by Sawa fig. 3: "123B" and is used to enable the controller to cause to flow between the supply and a synchronous motor a generally sinusoidal current that is synchronized to the angular displacement of the rotor)..

8. As to claim 11, Sawa teaches a synchronous motor drive as claimed in claim 8, wherein the synchronous motor is a permanent-magnet synchronous motor (Sawa fig. 3: 200).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 3, 4, 6, 12-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,801,509 to Sawa published September 1, 1998 and further in view of U.S. Patent No. 4,891,764 to McIntosh published January 2, 1990.

11. As to claim 3, Sawa teaches a controller as claimed in claim 1. Sawa does not teach what is operable periodically to measure one or more parameters related to a torque of a synchronous motor, which parameters include a characteristic of a load coupled to the motor. McIntosh teaches what is operable periodically to measure one or more parameters related to a torque of a synchronous motor, which parameters include a characteristic of a load coupled to the motor (McIntosh col. 24: lines 40-47)

12. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement the teachings of Mcintosh into Sawa since Sawa suggests a synchronous motor controller and Mcintosh suggests the beneficial use of the current to calculate the torque in the analogous art of electric motor control and measurement.

13. As to claim 4, Sawa teaches a controller as claimed in claim 1. Sawa does not teach which is operable to store a mathematical model of a synchronous motor, and to derive the at least one estimated angular displacement signal by inserting the measured parameters into the mathematical model. Mcintosh teaches which is operable to store a mathematical model of a

synchronous motor, and to derive the at least one estimated angular displacement signal by inserting the measured parameters into the mathematical model (Mcintosh fig. 12 and fig. 13).

14. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement the teachings of Mcintosh into Sawa since Sawa suggests a synchronous motor controller and Mcintosh suggests the beneficial use of the software subroutine [mathematical model] to calculate torque, speed or acceleration in the analogous art of electric motor control and measurement (Mcintosh col. 28: lines 36-54).

15. As to claim 6, Sawa teaches a controller as claimed in claim 1. Sawa does not teach which is operable, upon receiving an actual angular displacement signal, to subtract an estimated angular displacement signal from the actual angular displacement signal, to generate an angular displacement error signal and to adjust the mathematical model so as to reduce the magnitudes of subsequent angular displacement error signals. Mcintosh teaches which is operable, upon receiving an actual angular displacement signal, to subtract an estimated angular displacement signal from the actual angular displacement signal, to generate an angular displacement error signal and to adjust the mathematical model so as to reduce the magnitudes of subsequent angular displacement error signals (Mcintosh col. 1: lines 30-44 where a method is taught to generate an angular displacement error and make an adjustment for the measured parameter until the error signal is equal to zero).

16. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement the teachings of Mcintosh into Sawa since Sawa suggests a synchronous motor controller and Mcintosh suggests the beneficial use of an error signal to adjust the measured parameter in the analogous art of electric motor control and measurement

(Mcintosh col. 1: lines 30-44).

17. As to claim 12, Sawa teaches a synchronous motor drive as claimed in claim 8. Sawa does not teach a sensor means comprises a plurality of Hall effect sensors. Mcintosh teaches a sensor means comprises a plurality of hall effect sensors (Mcintosh col. 8: lines 49-50 "other types of angular position sensing means such as hall effect devices").

18. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement the teachings of Mcintosh into Sawa since Sawa suggests an angular position detector for a synchronous motor and Mcintosh suggests the beneficial use of hall effect devices for angular position sensing (Mcintosh col. 8: lines 49-50 "other types of angular position sensing means such as hall effect devices") in the analogous art of electric motor control and measurement.

19. As to claim 13, Sawa teaches a synchronous motor drive as claimed in claim 12. Sawa does not teach wherein the sensor means comprises three Hall effect sensors, which are so arranged relative to the motor as to generate an actual angular displacement signal for each 60 degree of angular displacement of the rotor from the reference orientation. Mcintosh teaches wherein the sensor means comprises three Hall effect sensors, which are so arranged relative to the motor as to generate an actual angular displacement signal for each 60 degree of angular displacement of the rotor from the reference orientation (Mcintosh fig. 3: 37 where a device of angular displacement of the rotor is taught).

20. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement the teachings of Mcintosh into Sawa since Sawa suggests an angular position detector for a synchronous motor and Mcintosh suggests the beneficial use of

hall effect devices for angular position sensing (Mcintosh col. 8: lines 49-50 "other types of angular position sensing means such as hall effect devices") in the analogous art of electric motor control and measurement.

21. As to claim 14, Sawa teaches a synchronous motor drive as claimed in claim 8. Sawa does not teach wherein the controller is operable to measure the one or more parameters related to the speed of the motor and to transmit an actual or estimated angular displacement signal to the controllable ac supply at intervals that are much less than a response time of the motor. Mcintosh teaches wherein the controller is operable to measure the one or more parameters related to the speed of the motor and to transmit an actual or estimated angular displacement signal to the controllable ac supply at intervals that are much less than a response time of the motor (Mcintosh col. 2: lines 33-37 where a method of response time adjustment is taught).

22. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement the teachings of Mcintosh into Sawa since Sawa suggests an angular position detector for a synchronous motor and Mcintosh suggests the beneficial use of the response time adjustment technique for parameter measurement (Mcintosh col. 2: lines 33-37) in the analogous art of electrical motor control and measurement.

23. As to claim 15, Sawa teaches a synchronous motor drive as claimed in claim 8, which further comprises a governor operable to receive estimated angular velocity signals from the controller (Sawa fig. 3: 122 "speed controller"). Sawa does not teach a method to subtract the estimated angular velocity signals from a demanded angular velocity signal representative of a demanded angular velocity of the rotor set by a user of the drive, so as to generate an angular

velocity error signal, and to cause the controllable ac supply to increase or decrease the amplitude of the generally sinusoidal current so as to reduce the magnitudes of the angular velocity error signals. Mcintosh teaches a method to subtract the estimated angular velocity signals from a demanded angular velocity signal representative of a demanded angular velocity of the rotor set by a user of the drive, so as to generate an angular velocity error signal, and to cause the controllable ac supply to increase or decrease the amplitude of the generally sinusoidal current so as to reduce the magnitudes of the angular velocity error signals (Mcintosh col. 1: lines 30-44 where a method is taught to generate an angular displacement error and make an adjustment for the measured parameter until the error signal is equal to zero).

24. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement the teachings of Mcintosh into Sawa since Sawa suggests a synchronous motor controller and Mcintosh suggests the beneficial use of an error signal to adjust the measured parameter in the analogous art of electric motor control and measurement (Mcintosh col. 1: lines 30-44).

25. As to claim 16, Sawa teaches a method of controlling a synchronous motor (Sawa fig. 3: 100B "motor control apparatus), comprising the steps of receiving from sensor means coupled to a synchronous motor an actual angular displacement signal representative of an angular displacement from a reference orientation of a rotor of the motor (Sawa fig. 3: 300 "encoder", 123B "angular signal detector"), transmitting the actual angular displacement signal to a controllable alternating current (ac) supply (Sawa fig. 3: 124B "current command generator" which is used to transmit the actual angular displacement signals to the current controller [Sawa fig. 3: 126] to supply AC current for the motor [Sawa fig.3: 200]), measuring one or more

parameters related to an angular acceleration of the rotor (Sawa fig. 3: 121 "speed detector", 126 "current controller" and 140 "power supply voltage detector" which are related to the torque of a synchronous motor[speed, voltage, current are used to determine a motor torque]), Transmitting the estimated angular displacement signal to the controllable ac supply, and thereby causing to flow between the controllable ac supply and the motor a generally sinusoidal current that is synchronized to the angular displacement of the rotor (Sawa fig. 3 and col. 7: lines 5-58 where the angular displacement signal is detected by Sawa fig. 3: "123B" and is used to enable the controller to cause to flow between the supply and a synchronous motor a generally sinusoidal current that is synchronized to the angular displacement of the rotor). Sawa does not teach a method of using a mathematical model of the motor, from the actual displacement signal and the one or more parameters an estimated angular displacement signal representative of an estimated angular displacement of the rotor. Mcintosh teaches a method of using a mathematical model of the motor, from the actual displacement signal and the one or more parameters an estimated angular displacement signal representative of an estimated angular displacement of the rotor (Mcintosh col. 1: lines 30-44 where a method is taught to generate an angular displacement error and make an adjustment for the measured parameter until the error signal is equal to zero).

26. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement the teachings of Mcintosh into Sawa since Sawa suggests a synchronous motor controller and Mcintosh suggests the beneficial use of an error signal to adjust the measured parameter in the analogous art of electric motor control and measurement (Mcintosh col. 1: lines 30-44).

27. As to claim 17, Sawa in view of Mcintosh teaches a method as claimed in claim 16, which further comprises the step of measuring the one or more parameters related to an angular acceleration of the rotor (Sawa fig. 3: 121 “speed detector” and 122 “speed controller”), deriving, using the mathematical model, from the estimated angular displacement and the one or more parameters a further estimated angular displacement signal representative of an estimated angular displacement of the rotor, and transmitting the further estimated angular displacement signal to the controllable ac supply (Sawa fig. 3 and col. 7: lines 5-58 where the angular displacement signal is detected by Sawa fig. 3: “123B” and is used to enable the controller to cause to flow between the supply and a synchronous motor a generally sinusoidal current that is synchronized to the angular displacement of the rotor).

28. As to claim 18, Sawa in view of Mcintosh teaches a method as claimed in claim 17, which further comprises the step, upon receipt of an actual angular displacement signal, of comparing the actual angular displacement signal with a further estimated angular displacement signal to generate an angular displacement error signal, and adjusting the mathematical model so as to reduce the magnitude of subsequent angular displacement signals (Mcintosh col. 1: lines 30-44 where a method is taught to generate an angular displacement error and make an adjustment for the measured parameter until the error signal is equal to zero).

29. Claims 9, 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,801,509 to Sawa published September 1, 1998 and further in view of U.S. Patent No. 6,008,614 to Imai published December 28, 1999.

30. As to claim 9, Sawa teaches a synchronous motor drive as claimed in claim 8. Sawa does not teach a device wherein the controllable ac supply is a PWM inverter. Imai teaches a device wherein the controllable ac supply is a PWM inverter (Imai fig. 13: 4 "PWM inverter).

31. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to implement the teachings of Imai into Sawa since Sawa suggests a synchronous motor controller and Imai suggests the beneficial use of PWM inverter (Imai col. 9: lines 20-30) in the analogous art of electric motor control and measurement.

32. As to claim 10, Sawa in view of Imai teaches a synchronous motor drive as claimed in claim 9, wherein the PWM inverter is a three-phase inverter (Imai fig. 13: 4 "PWM inverter) and the synchronous motor is a three-phase synchronous motor (Sawa fig. 3: 200).

Conclusion

33. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Luo whose telephone number is (571)270-5251. The examiner can normally be reached on M-F 8AM-5PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pankaj Kumar can be reached on (571)272-3011. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-

direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

David Luo
Art Unit 4192
/Pankaj Kumar/

Supervisory Patent Examiner, Art Unit 4192